tampicana Web. l.c. 939, July, 1898. *Per. Philippii* Web. l.c. 939, July, 1898. *Phyllocactus phyllanthus* Link. vars. *boliviensis* Web., *paraguayensis* Web., and *columbiensis* Web. l.c. 957, July, 1898.

Besides these descriptions of new species, Dr. Weber makes a number of new combinations in nomenclature which are here given, with sufficient synonymy only for identification. *Anhalonium turbiniforme* Web. (*Echino. turbiniformis* Pfeif.) in Bois's *Dict. d'Hort.*, 90, June, 1893. *Echinocactus latispinus* Web. (*Echino. cornigerus* DC.; *Cactus latispinus* Haw.) l.c. 467, Sept. 1896. *Echinopsis catamarcensis* Web. (*Cer. catamarcensis* Web.) l.c. 471, Sept. 1896. *Echinopsis minuscula* Web. (*Echino. minusculus* Web.) l.c. 471, Sept. 1896. *Echinopsis obrepanda* Web. (*Echino. obrepandus* Web.) l.c. 472, Sept. 1896. *Echinopsis Schickendantzii* Web. (*Cer. Schickendantzii* Web.) l.c. 473, Sept. 1896. *Mamillaria pectinifera* Web. (*Pelecyphora acelliformis* Ehrenb. var. *pectinata* Hort.) l.c. 804, Jan. 1898. *Opuntia cereiformis* Web. (*Grusonia cereiformis* Hort., *Cer. Bradtianus* Coult.) l.c. 897, May, 1898. *Op. spathulata* Web. (*Pereskia spathulata* Otto) l.c. 899, May, 1898. *Pereskia Amapola* Web. (*Per. horrida* Parodi., *Per. Bleo* Morong) l.c. 938, July, 1898. *Pfeiffera ianthothele* Web. (*Pf. cereiformis* Salm., *Cer. ianthothele* Monv.) l.c. 944, July, 1898.

C. H. T.

Fertilization of Cycas. — An important recent paper by Professor S. Ikeno,[1] of Tokyo, Japan, treats of the development of the sexual products and the process of fertilization in *Cycas revoluta*. Incidentally it throws light on the relationships of the Cycads, but its chief interest lies in its bearing on the general problems of cell structure and fertilization.

In the development of the archegonia within the endosperm, Ikeno distinguishes three periods corresponding with those which are recognized in the development of animal sexual products. These are:

1. A period of *division*, in which the archegonial cells are differentiated.

2. A period of *growth*, during which the central cell (egg-cell) of the archegonium attains a relatively enormous size, its nucleus alone being 75–120 mikra in diameter. The growth takes place at the expense of cells which surround the central cell, their nuclei being actively engaged in the formation of granular food substance which is passed on into the central cell through pores in the intervening cell walls.

[1] *Journal of the College of Science*, Imperial University, Tokyo, vol. xii, Pt. iii, pp. 151–214; Pls. X–XVII.

This is exactly parallel with what takes place in the growth of the shark's egg at the expense of its follicle cells, and reminds us also of similar processes in insect eggs.

3. A *maturation* period, in which the central cell is prepared for fertilization. This consists in a very unequal cell division, resulting in the formation of a small canal cell which rests as a small cap on the peripheral end of the large, oval egg-cell.

Pollination occurs in June or July, and is shortly followed by the formation of the pollen tube at about the same time that the archegonium is being differentiated. The changes which take place in the pollen tube leading to the formation of motile spermatozoa cover a period of two months or more, at the end of which period fertilization is accomplished, in September or October.

A pollen grain is spherical in form, containing three cells placed in a row, namely, a large "embryonal cell" and two small flattened "prothallium cells." The embryonal cell plays the principal part in the formation of the pollen tube, occupying a position near its growing tip, the prothallium cells meanwhile remaining quiescent at the opposite end of the tube. Having formed the pollen tube, which now lies imbedded in the endosperm, the embryonal cell seems to have performed its principal function, and it subsequently disintegrates.

The larger prothallium cell, the one which was next to the embryonal cell in the pollen grain, may be regarded as a primordial germ cell; it now begins to develop, passing successively through stages of division, growth, and maturation, corresponding to those which occur in animal spermatogenesis. In the first of these stages nuclear division occurs without division of the cytoplasm, one of the nuclei being thrown out into the pollen tube as the "Stielzelle."

Early in the second, or growth period, centrosomes appear in the germinal cell (spermatocyte, to use the terminology of animal spermatogenesis) on opposite sides of the nucleus. These are very large deeply staining bodies, which persist throughout the subsequent development and have an interesting fate. The spermatocyte attains a diameter of about 0.14 mm., its large nucleus being about 60 mikra in diameter, and the centrosomes 10–15 mikra (!) in diameter. The centrosomes, except for a few vacuoles which they contain, are solid structures, as is shown by the fact that they can be broken into fragments by pressure. Around them are seen faint cytoplasmic radiations.

Maturation is accomplished by the completion of the division

foreshadowed by the presence of the centrosomes during the growth period. Two hemispherical spermatids are thus formed, each containing a large nucleus and centrosome. Each spermatid metamorphoses into a motile (ciliated) spermatozoön of about the shape of the spermatozoön of Ascaris, so well known to zoölogists. During this metamorphosis the centrosome resolves itself into an elongated band-like structure in the cytoplasm; from one side of it radiations are seen projecting. A process of the nucleus is for a long time directed outward toward the deep end of this band, indicating that the nucleus is concerned in the changes which are taking place. The centrosome band ultimately comes to lie in a long spiral of about five turns just under the curved surface of the cell. The cytoplasmic radiations emerge from the surface as a spiral band of cilia, which remain attached to the centrosome band as to a basal plate; they form the locomotor apparatus of the spermatozoön. The greater part of the mature spermatozoön consists of a large nucleus, which is covered with a thin but perfectly distinct layer of cytoplasm, in which lies the centrosome band bearing the cilia.

Ikeno regards the centrosome band as homologous with the middle piece of the animal spermatozoön, the centrosome being known to pass into the middle piece in animal spermatogenesis; the cilia he regards as corresponding with the flagellum of animal spermatozoa. In fertilization a spermatozoön makes its way through the fluid which has accumulated around the egg-cell, bores into the egg-cell and loses its cilia and cytoplasm, after which its nucleus moves toward the oval egg nucleus, sinking into a ready formed depression (Empfängnisshöhle) on its peripheral end. The sperm and egg nuclei now fuse completely, no centrosome being visible during the process, nor in the nuclear division which follows. In this division the spindle fibers do not converge at either end of the mitotic figure, but lie parallel with each other throughout their whole length. The entire absence of centrosomes during fertilization is strongly in contrast to what is known of fertilization in animals.

W. E. C.

Botrytis and its Host. — The relation of Botrytis to its host plants has recently been studied by Nordhausen.[1] With some preliminary account of the infection of living plants by this fungus through the surface of wounds, where by reason of the injured cells Botrytis may readily begin its usual saprophytic existence, he passes to

[1] Nordhausen, M. Beiträge zur Biologie parasitärer Pilze, *Jahrb. f. Wissenschaft*, Botanik, Bd. xxxiii, pp. 1–46.